WHAT IS CLAIMED IS:

1. A medical device for use in treating a human patient, comprising:
a substrate having an average grain size of less than twenty microns.

2. The device of claim 1, wherein the average grain size of the substrate is in the range of one to ten microns.

3. The device of claim 1, wherein the substrate is a stainless steel.

4. The device of claim 3, wherein the substrate is 316L stainless steel.

5. The device of claim 4, wherein the average grain size of the substrate is in the range of three to eight microns.

6. The device of claim 1, wherein the substrate is a cobalt-chromium alloy.

7. The device of claim 1, wherein the substrate is a nickel-titanium alloy.

8. The device of claim 1, wherein the substrate is a platinum-iridium alloy.

9. The device of claim 1, wherein the substrate is titanium or a titanium based alloy.

10. The device of claim 1, wherein the substrate is tantalum or a tantalum based alloy.

11. The device of claim 1, wherein the medical device is formed from a hypotube.

12. The device of claim 1, wherein the medical device is formed from a wire.

13. The device of claim 1, wherein the medical device is an intravascular device.

14. The device of claim 1, wherein the medical device is a stent.

15. The device of claim 14, wherein the stent is configured with a plurality of struts having a thickness, such that the number of grains across a strut thickness is in the range of five to fifteen.

16. The device of claim 14, wherein the stent is configured with a plurality of elongate elements having a thickness, such that the average number of grains across an element thickness is more than six.

17. The device of claim 1, wherein the medical device is part of an embolic protection filter.

18. The device of claim 1, wherein the medical device is an attachment system for an endovascular graft.

19. The device of claim 1, wherein the medical device is a guide wire.

20. The device of claim 1, wherein the medical device is a wire lead.

21. The device of claim 1, wherein the medical device is a catheter.

22. An intravascular stent for use in a body lumen, comprising:

a plurality of cylindrical rings interconnected to form the stent, each cylindrical ring having a first delivery diameter and a second expanded diameter; and

each cylindrical ring being formed from a fine grained material.

23. The intravascular stent of claim 22, wherein the cylindrical rings are formed from 316L stainless steel having an average grain size in the range of one to ten microns.

24. The intravascular stent of claim 22, wherein the cylindrical rings are formed from 316L stainless steel having an average grain size of about five microns.

25. The intravascular stent of claim 22, wherein the cylindrical rings are formed from 316L stainless steel having an average grain size of less than twenty microns.

26. The intravascular stent of claim 22, further comprising at least one straight link attaching each cylindrical ring to an adjacent cylindrical ring.

27. The intravascular stent of claim 22, further comprising at least one undulating link attaching each cylindrical ring to an adjacent cylindrical ring.

28. The intravascular stent of claim 22, further comprising at least one undulating link attaching a first cylindrical ring to a first adjacent cylindrical ring, and at least one straight link attaching a second cylindrical ring to a second adjacent cylindrical ring.

29. The intravascular stent of claim 22, wherein each cylindrical ring includes a proximal end, a distal end and a cylindrical wall extending circumferentially between the proximal end and the distal end, and further including an undulating link positioned substantially within the cylindrical wall of a first cylindrical ring so as to attach the first cylindrical ring to an adjacent cylindrical ring.

30. A method of manufacturing a fine grained medical device, the method comprising:

providing a specimen of a metal or metal alloy;

heating the specimen to a recrystallization temperature of the specimen;

holding the temperature of the specimen about the recrystallization temperature so as to stabilize the specimen temperature;

deforming the specimen in more than one axis to a net deformation in the range of about seventy-five percent to about ninety-five percent;

holding the specimen temperature about the recrystallization temperature for a predetermined time to achieve a desired grain size in the specimen;

cooling the specimen to about room temperature; and

forming a medical device from the specimen.

31. The method of claim 30, wherein forming a medical device from the specimen includes configuring a stent.

32. The method of claim 31, wherein configuring the stent includes configuring a plurality of connected cylindrical rings.

33. The method of claim 30, further comprising forming a thin-walled tube from the specimen, and using a machine-controlled laser to cut the thin-walled tube so as to configure a stent with a plurality of connected cylindrical rings.

34. A medical device constructed according to the method of claim 30.

35. A method of manufacturing a fine grained medical device, the method comprising:

providing a specimen of a metal or metal alloy;

heating the specimen to a first recrystallization temperature of the specimen;

holding the temperature of the specimen about the first recrystallization temperature so as to stabilize the specimen temperature;

deforming the specimen in more than one axis to a net deformation in the range of about seventy-five percent to about ninety-five percent;

cooling the specimen to about room temperature;

heating the specimen at a rate sufficient to prevent recovery before attaining a second recrystallization temperature of the specimen;

holding the specimen temperature about the second recrystallization temperature for a time ranging from about one minute to about ten minutes;

cooling the specimen to about room temperature; and

forming a medical device from the specimen.

36. A medical device constructed according to the method of claim 35.

37. A method of manufacturing fine grained 316L stainless steel, the method comprising:

providing a specimen of 316L stainless steel;

heating the specimen to a temperature in the range of about 800 °C to about 1100 °C;

holding the temperature of the specimen in the range of about 800 °C to about 1100 °C for about one minute to stabilize the specimen temperature;

subjecting the specimen to multi-axial deformation to yield a net deformation in the range from about seventy-five percent to about ninety-five percent;

holding the specimen temperature in the range of about 800 °C to about 1100 °C for a predetermined time to achieve a desired grain size in the specimen; and

cooling the specimen to about room temperature to halt the recrystallization process.

38. A method of manufacturing fine grained 316L stainless steel, the method comprising:

providing a specimen of 316L stainless steel;

heating the specimen to a temperature in the range of about 800 °C to about 1100 °C;

holding the temperature of the specimen in the range of about 800 °C to about 1100 °C for about one minute to stabilize the specimen temperature;

subjecting the specimen to multi-axial deformation to yield a net deformation in the range from about seventy-five percent to about ninety-five percent;

cooling the specimen to about room temperature;

heating the specimen at a rate sufficient to prevent recovery before attaining a temperature in the range of about 800 °C to about 1100 °C;

holding the specimen temperature in the range of about 800 °C to about 1100 °C for about two minutes; and

cooling the specimen to about room temperature to halt the recrystallization process.

39. A method of manufacturing a fine grained cobalt-chromium alloy, the method comprising:

providing a specimen of cobalt-chromium alloy;

heating the specimen to a first temperature in the range of about 1050 °C to about 1250 °C;

stabilizing the specimen temperature about the first temperature;

subjecting the specimen to multi-axial deformation to yield a net deformation in the range from about seventy-five percent to about ninety-five percent;

cooling the specimen to about room temperature;

heating the specimen at a rate sufficient to prevent recovery before attaining a second temperature in the range of about 1050 °C to about 1250 °C;

holding the specimen temperature about the second temperature for a time ranging from about one minute to about ten minutes; and

cooling the specimen to about room temperature.

40. A method of delivering a stent into a desired location within a patient's vasculature, the method comprising:

providing a catheter assembly including a catheter shaft having a proximal end portion and a distal end portion, an inflatable member formed on the distal end portion of the catheter shaft, and a stent disposed on the inflatable member and configured from a plurality of cylindrical rings interconnected to form the stent, each cylindrical ring being formed from a fine grained material;

advancing the distal end portion of the catheter shaft, the inflatable member and the stent though the vasculature to a desired location;

inflating the inflatable member so as to expand the stent into the desired location;

deflating the inflatable member; and

withdrawing the catheter shaft and the inflatable member from the vasculature.